

**Victorian Certificate of Education
2015**

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER Letter

VCE VET ENGINEERING STUDIES

Written examination

Wednesday 18 November 2015

Reading time: 9.00 am to 9.15 am (15 minutes)

Writing time: 9.15 am to 10.45 am (1 hour 30 minutes)

QUESTION AND ANSWER BOOK

Structure of book

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
A	20	20	20
B	19	19	80
			Total 100

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, one scientific calculator, a protractor, a set square and aids for curve sketching.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

Materials supplied

- Question and answer book of 29 pages.
- Answer sheet for multiple-choice questions.

Instructions

- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- All written responses must be in English.

At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

SECTION A – Multiple-choice questions**Instructions for Section A**

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** or that **best answers** the question.

A correct answer scores 1, an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Question 1

What do the letters MSDS represent?

- A. material safety data sheet
- B. material standard data sheet
- C. material standard data source
- D. material standard derived selection

Question 2

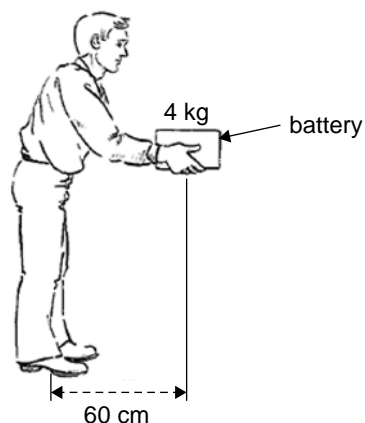
After using a hacksaw, a worker returned the hacksaw to the tool rack.

Which one of the following steps was undertaken under the 5S system?

- A. Standardise
- B. Sustain
- C. Sort
- D. Set

Question 3

For safety reasons, the worker in the diagram below was advised that he should not carry a battery against his body in case any acid leaked out.



Source: *Code of Practice for Manual Handling*,
Victorian WorkCover Authority, no. 25, 20 April 2000, p. 26

As the battery weighs 4 kg, the worker should

- A. use an appropriate lifting cradle to hold the battery at the side of his body.
- B. seek the assistance of a second person to carry the battery between them.
- C. continue as shown, but hold the battery only 40 cm away from his body.
- D. wear an acid-proof apron and hold the battery close, against his body.

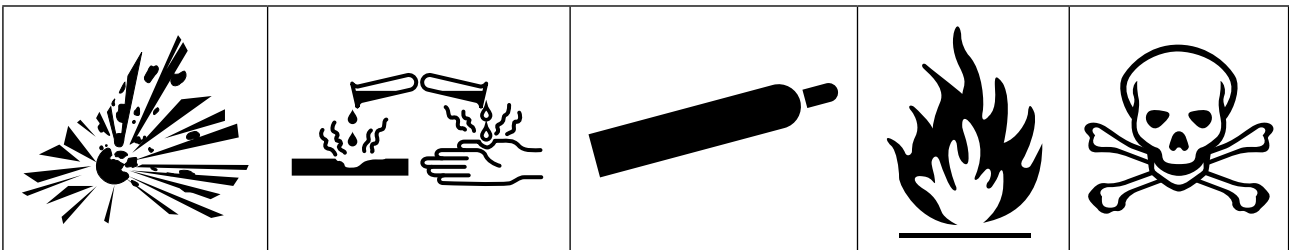
Question 4

A company finds that it typically has 12 lead acid (LA) batteries to dispose of every six months. To improve the company's sustainability practices, the best option would be to

- A. store the old LA batteries outside for a recycler to collect annually.
- B. explore the option of replacing the LA batteries with a different battery technology.
- C. allow the employees to take the old LA batteries home for their families to use.
- D. break open the batteries with a hammer, drain the acid and recover the lead for recycling, which could then be sold for scrap metal.

Question 5

Below are five hazard symbols that are often displayed in an engineering workshop.



Which of the following correctly identifies the five symbols in order from left to right?

- A. gas under pressure, explosive, toxic, flammable, corrosive
- B. explosive, flammable, gas under pressure, corrosive, toxic
- C. gas under pressure, flammable, corrosive, toxic, explosive
- D. explosive, corrosive, gas under pressure, flammable, toxic

Question 6

Which one of the following best describes the main aim of a company in implementing the 5S system?

- A. a well-trained workforce
- B. better-maintained equipment
- C. a better-organised workplace
- D. a better work–life balance for employees

Question 7

A company conducts a half-yearly internal audit of all of its work areas. Under which step of the 5S system does the audit fall?

- A. Shine the work area
- B. Standardise activities
- C. Sustain the 5S system
- D. Set the workplace in order

Question 8

Holistic judgments of sustainability in the workplace take into consideration the

- A. environmental, economic and social factors.
- B. obvious hazards to the environment.
- C. financial and economic costs.
- D. environmental aspects.

Question 9

Employees have some personal responsibilities with respect to occupational health and safety (OH&S) in the workplace.

Some personal responsibilities in the workplace may include the following:

1. Taking out the garbage.
2. Following all reasonable instructions you are given.
3. Taking reasonable care of your own health and safety in the workplace.
4. Correctly using and looking after any personal protective equipment (PPE) provided.

Which of the following includes **only** personal responsibilities imposed by OH&S legislation?

- A. 1, 2, 3
- B. 1, 2, 4
- C. 1, 3, 4
- D. 2, 3, 4

Question 10

A worker received a new set of tools and assigned a place for each new tool in the appropriate storage cabinet.

Which 5S step was undertaken by this worker's action?

- A. Shine the workplace
- B. Set the workplace in order
- C. Standardise the location of the tools
- D. Sort the new tools from the old tools

Question 11

Which task has the main focus during the Sort stage of the 5S system?

- A. sorting the new tools from the old tools
- B. ensuring that sharp tools are removed from the workplace
- C. inspecting the work area to ensure compliance with 5S principles
- D. removing the non-essential tools, components and equipment from the workplace

Question 12

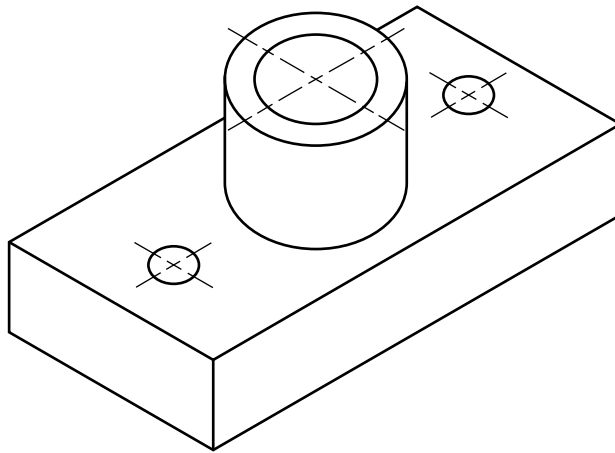
Upon joining a new company, a worker is provided with a previously used and unorganised toolbox, as shown below.



When applying the 5S system, what is the first step the worker should undertake?

- A. sustain the 5S system by recommending improvements to the toolbox
- B. identify the best location for each essential item in the toolbox
- C. remove unwanted items from the toolbox
- D. clean the work area around the toolbox

Use the following information to answer Questions 13 and 14.



Question 13

The drawing shown above is

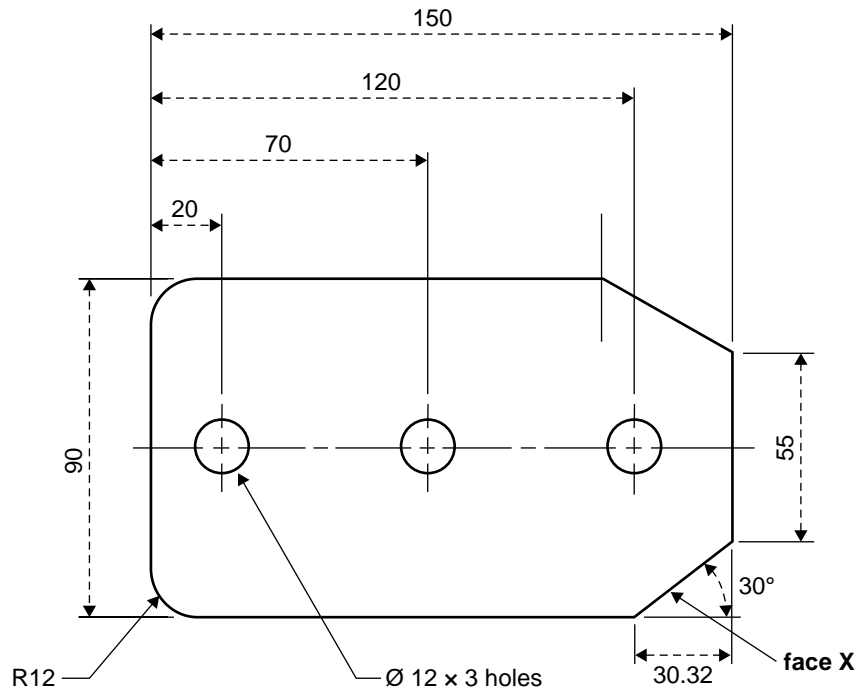
- A. an isometric view.
- B. a sectioned drawing.
- C. an elongated drawing.
- D. a third-angle projection.

Question 14

The 'cross-hair' lines on the drawing indicate

- A. drilled holes.
- B. centre lines for drilling.
- C. set-up markers for machining.
- D. the edges that threads will be cut into.

Use the following information to answer Questions 15–17.



Question 15

The spacing between the holes on the mounting plate shown above is

- A. 20
- B. 35
- C. 40
- D. 50

Question 16

What is the length of the angled 30° 'face X' shown on the mounting plate?

- A. 20.21
- B. 30
- C. 30.32
- D. 35

Question 17

The R12 indicates

- A. a 12 radius edge.
- B. a 12 diameter edge.
- C. the 12 drill-size that should be used.
- D. the regular 12 pencil edge finish on the mounting plate.

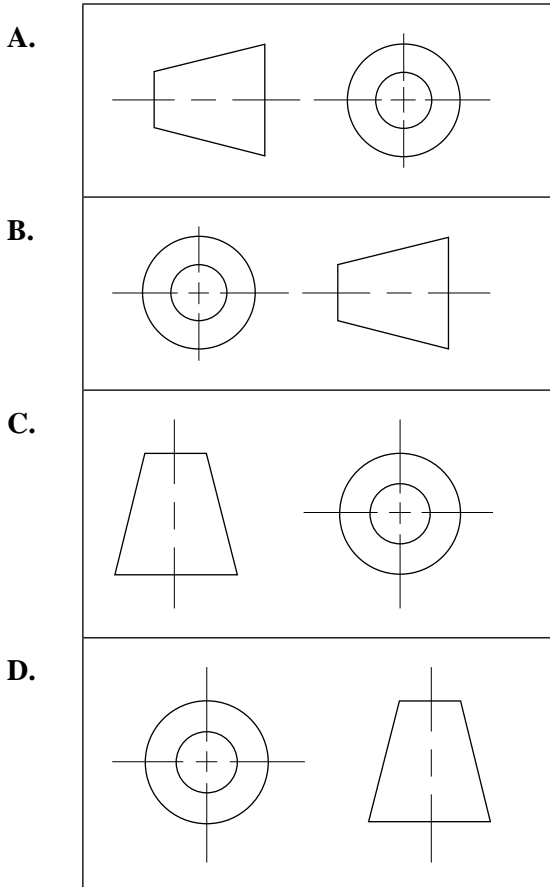
Question 18

Sustainability is best defined as

- A. always going about things in a logical way.
- B. finding plentiful resources that can be used and exploited.
- C. the considered endurance of systems and processes into the future.
- D. looking to the future to identify the economic potential in the years to come.

Question 19

Which pair of symbols represents third-angle projection drawing?



Question 20

A sectional view represents a cutaway view of an object.

On an engineering drawing, the cutaway cross-section is usually shown

- A. cross-hatched with continuous lines at an angle of 45°.
- B. cross-hatched with dashed lines at an angle of 45°.
- C. blackened out.
- D. whitened out.

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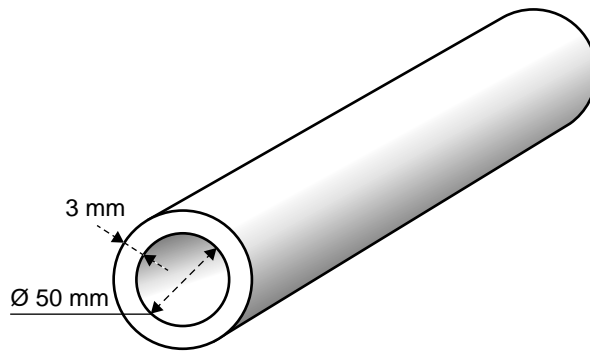
TURN OVER

SECTION B**Instructions for Section B**

Answer **all** questions in the spaces provided. All dimensions are in millimetres (mm).

Question 1 (5 marks)

Figure 1 below shows a section of 50 mm (internal) galvanised steel pipe.

**Figure 1**

- a. The steel pipe is measured by the diameter of the internal bore. This 50 mm galvanised pipe has a wall thickness of 3 mm.

What is the overall diameter of the pipe?

1 mark

- b. From the end, a 200 mm section of pipe has to be internally bored out to 51 mm, ± 0.1 mm.

Name the tool that would be used with the lathe for this process.

1 mark

- c. A 500 mm piece of 50 mm galvanised steel pipe has to be prepared for MIG welding.

How should the pipe be prepared before welding?

1 mark

- d. Additional precautions should be taken when working with arc or MIG welding galvanised steel, and not just mild steel.

State **one** precaution and provide the reason for this precaution.

2 marks

Question 2 (2 marks)

Figure 2 below shows a damaged power cord with exposed wires. It is plugged in and switched on.



Figure 2

Describe an immediate hazard in this situation and suggest two actions that would be required to control the hazard.

Description of hazard	Action
	1.
	2.

Question 3 (3 marks)

a. What is the purpose of personal protective equipment (PPE)?

1 mark

b. Provide two examples of PPE. Explain when each example would be used and why it would be required.

2 marks

Example of PPE	Used when and why?

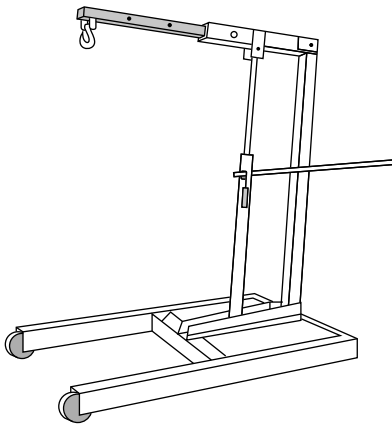
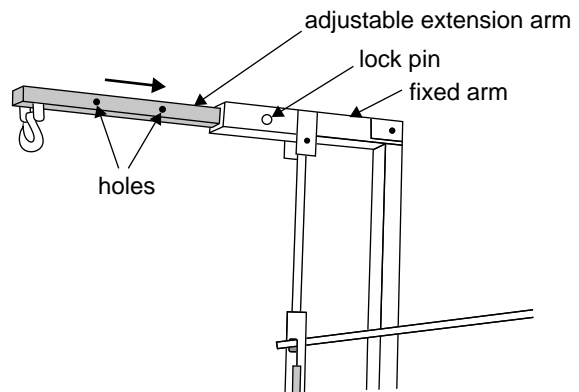
Question 4 (4 marks)

Identify two safety concerns when drilling into an aluminium bar in a bench drill press and explain how each concern could be managed.

Safety concern	Management

Question 5 (4 marks)

Figure 3a shows a common workshop machine and Figure 3b shows a close-up of the same machine.

**Figure 3a****Figure 3b**

- a. Name the workshop machine shown in Figure 3a. 1 mark

- b. Describe the principal use of this machine in a workshop using an example. 1 mark

- c. Refer to Figure 3b. The adjustable extension arm can be retracted back into the fixed arm. When the extension arm is retracted, the machine can lift a heavier load.

Explain why this is the case.

2 marks

Question 6 (2 marks)

A company has a procedure where workers must return a hammer to a designated tool cabinet after each use. The tool cabinet is located in the next room. A worker finds that this is not practical as the tool is used frequently.

What stage of the 5S system does this procedure correspond to and what action could be taken to fix the problem?

Relevant 5S stage	Action

Question 7 (7 marks)

a. Identify the 5S stage that would be implemented with each of the activities in the table below. 5 marks

5S activity	5S stage
general cleaning and painting of the work area	
items classified according to essential and non-essential tools	
best location for each tool identified based on frequency of use	
monthly audit of the work area implemented to ensure compliance with standards	
all personnel in the workshop briefed on the company's standard operating procedures	

b. Identify two specific benefits of implementing the 5S system. 2 marks

1. _____
2. _____

Question 8 (4 marks)

The following table shows an extract of the 5S audit report written after a routine inspection of a woodworking workshop.

Observation	
1.	A frequently needed screwdriver was kept in a tool cabinet located in the room next to the workshop.
2.	Tools were not returned to the assigned location at the end of the day.
3.	At the start of the day, the workers cleared the benchtop of sawdust and swept the floor to prepare for the day's work.
4.	The equipment maintenance status logbooks were not up to date.
5.	Above each worker's work area was a checklist of things to do at the beginning and end of each day.

- a. The extract of the audit report lists both compliance and non-compliance with the 5S system.

Referring to the observations in the extract, provide one potential area of improvement for each of the related 5S steps given below.

3 marks

5S step	Area of improvement
Sort	
Set	
Standardise	

- b. Auditing is an important part of the 5S system.

Identify the relevant 5S step for the following observation.

1 mark

	The audit ensures that work areas comply with the specified standards.
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Question 9 (3 marks)

Angelin’s company has the following workshop checklist. She is in charge of the workshop and the checklist is used to ensure that the necessary tasks are carried out each week.

Workshop checklist									
Owner: Angelin									
Room: 2–4									
Location: Building 1				Day	Mon.	Tue.	Wed.	Thu.	Fri.
				Date	4-May	5-May	6-May	7-May	8-May
s/n	Checks	Frequency	Initials of person responsible						
1.	All tools in assigned location	daily							
2.	Drill area cleaned	daily							
3.	Check scrap metal area cleared	every Monday			–	–	–	–	–
4.	Check oil level of machinery	every Wednesday		–	–		–	–	–

a. Give two benefits of using a checklist such as the one shown above. 2 marks

1. _____

2. _____

b. To which stage of the 5S system does a checklist belong? 1 mark

Question 10 (2 marks)

How do the 5S steps of Sorting and Setting in place reduce waste in an engineering workshop?

5S step	How waste reduction is achieved
Sort	
Set	

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Question 11 (7 marks)

Figure 4 shows the isometric view of a door wedge.

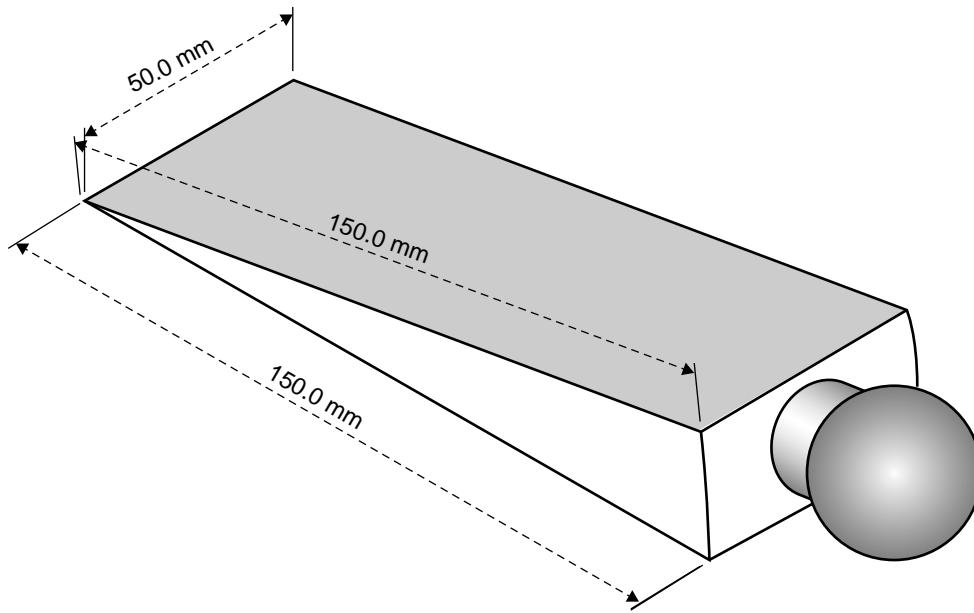
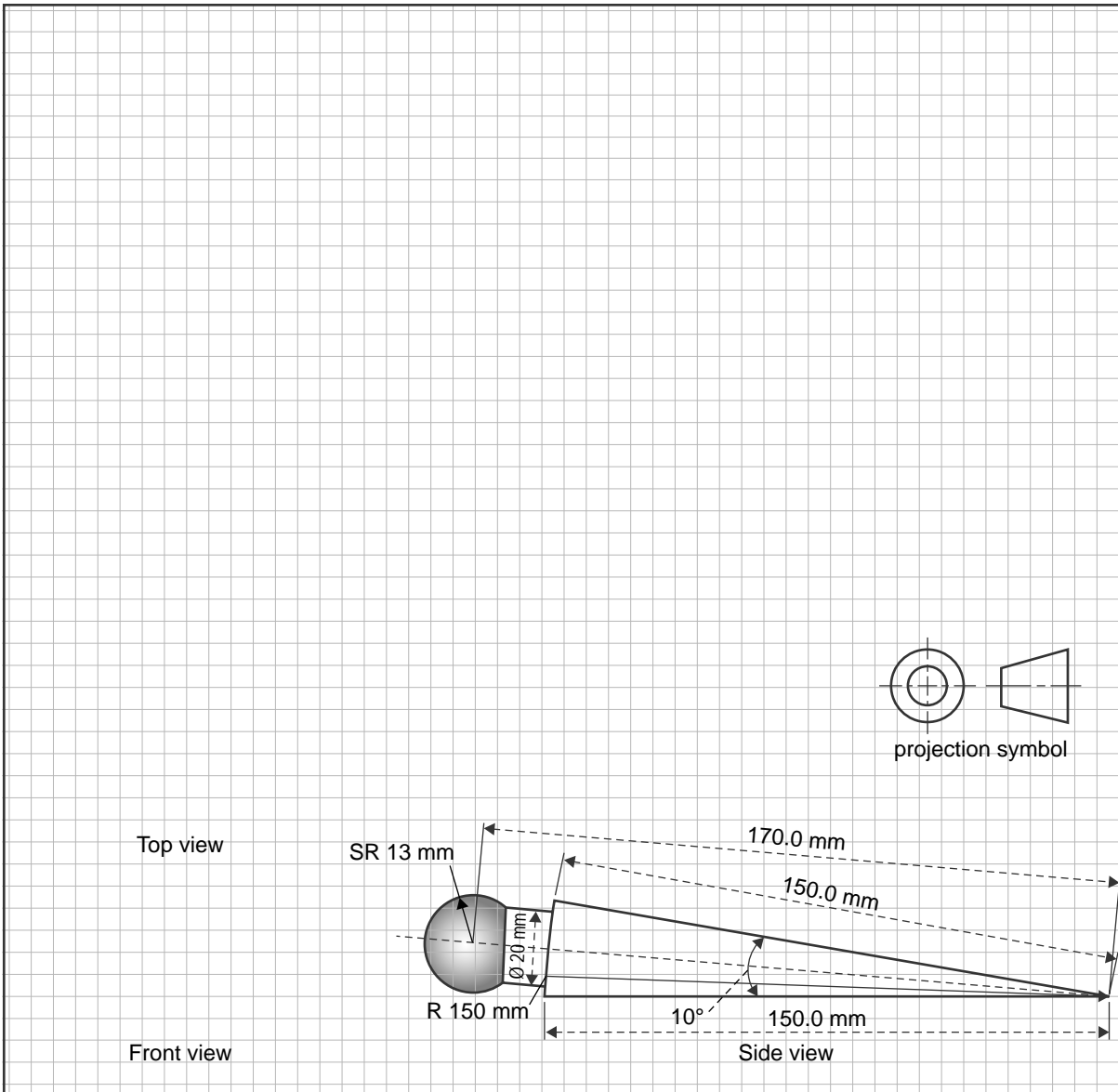


Figure 4

a. The side view of the door wedge is shown below.

In the space provided, sketch the orthogonal top and front views, including hidden lines, of the door wedge shown in Figure 4.

5 marks



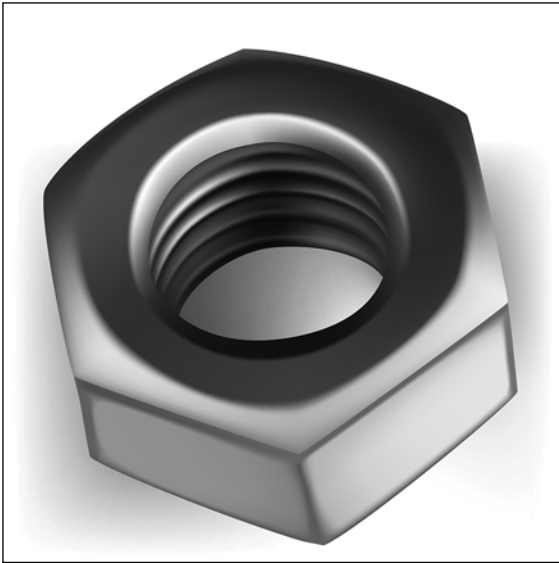
b. A company decided to make the door wedge from solid brass. This proved to function poorly as a door wedge.

Suggest **one** modification to improve the functionality of the door wedge and give a reason why the modification would be needed.

2 marks

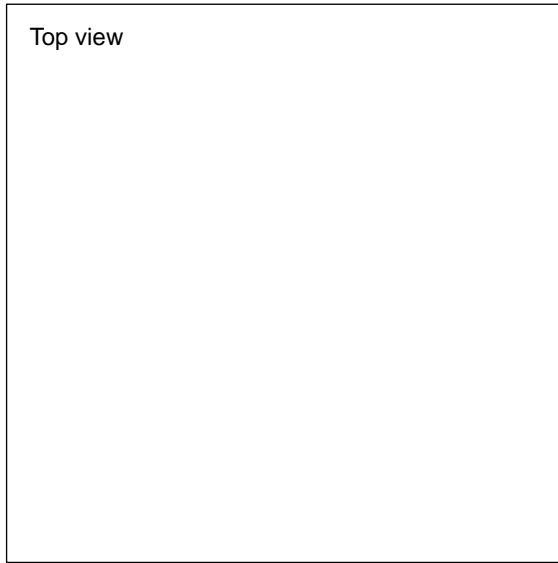
Question 12 (4 marks)

Sketch the items in Figure 5a and Figure 5b as each of them would be represented in a third-angle projection engineering drawing.



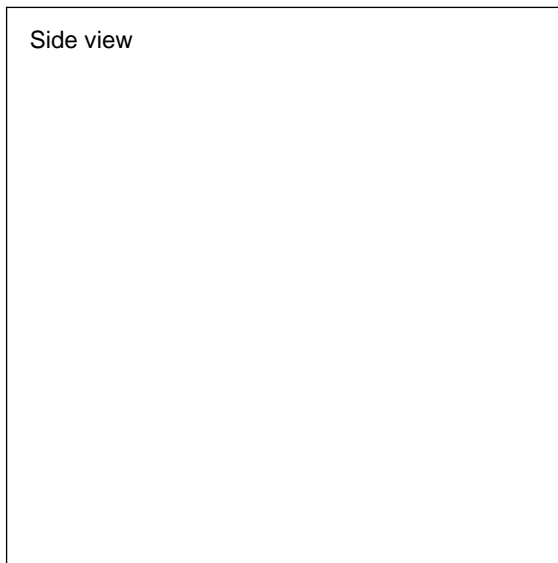
Source: ibragimova/Shutterstock.com

Figure 5a



Source: Roma Koshel/Shutterstock.com

Figure 5b



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Question 13 (4 marks)

Figure 6 shows a machined component. All dimensions are given in millimetres (mm).

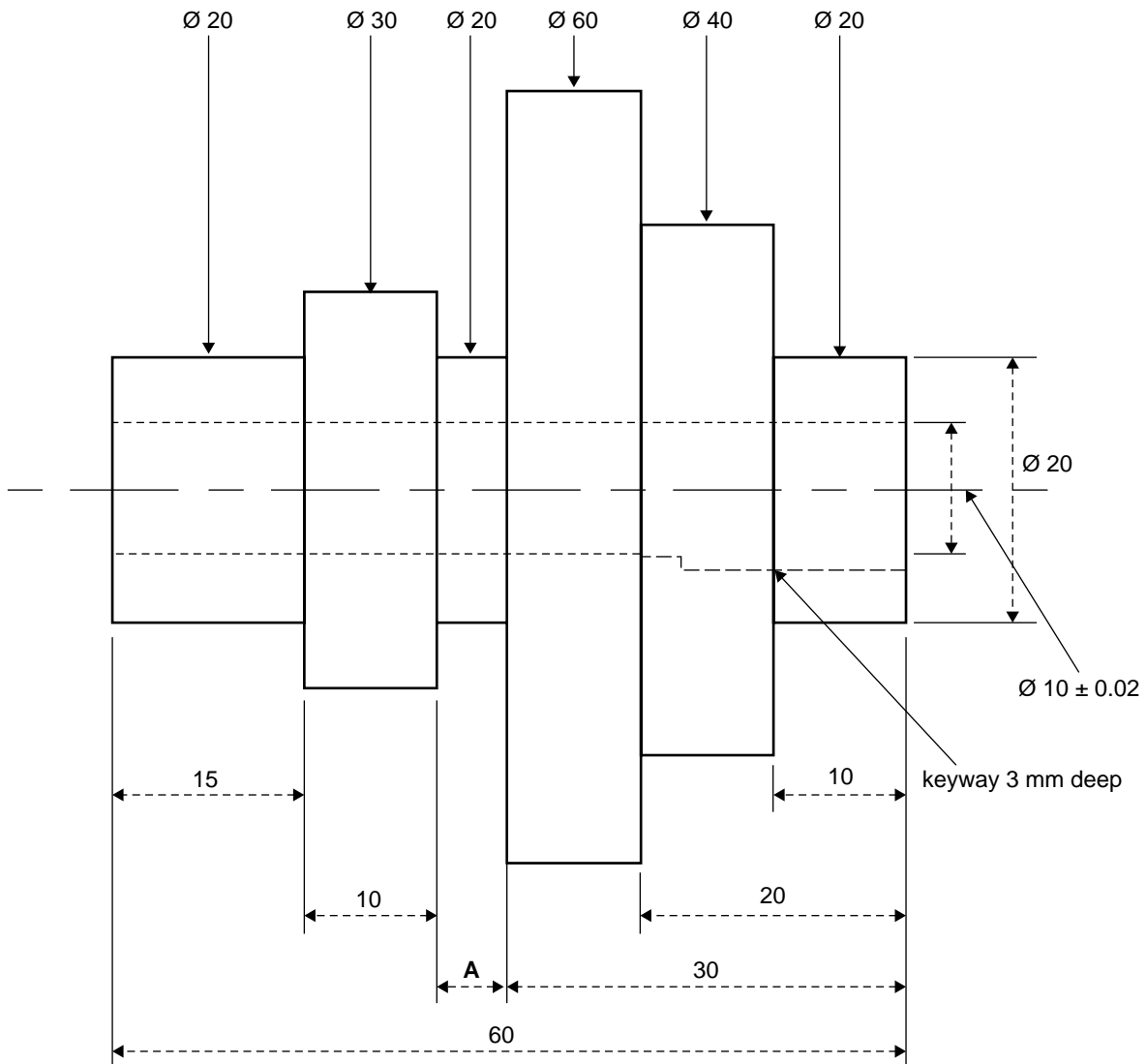


Figure 6

- a. Determine the length of dimension 'A' and state the units. 1 mark

- b. What are the maximum and minimum hole diameters specified for this machined component? 1 mark

- c. The $\text{Ø } 10 \text{ mm}$ shaft, shown in Figure 7 below, is fitted into the machined component shown in Figure 6. It has a 25 mm keyway.

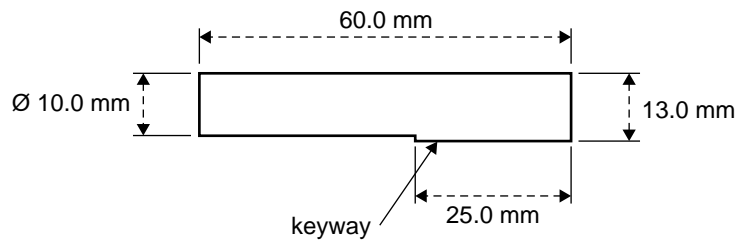


Figure 7

Explain the function of a keyway.

2 marks

Question 14 (4 marks)

Figure 8 shows the top, front and side views of a steel locating jig.

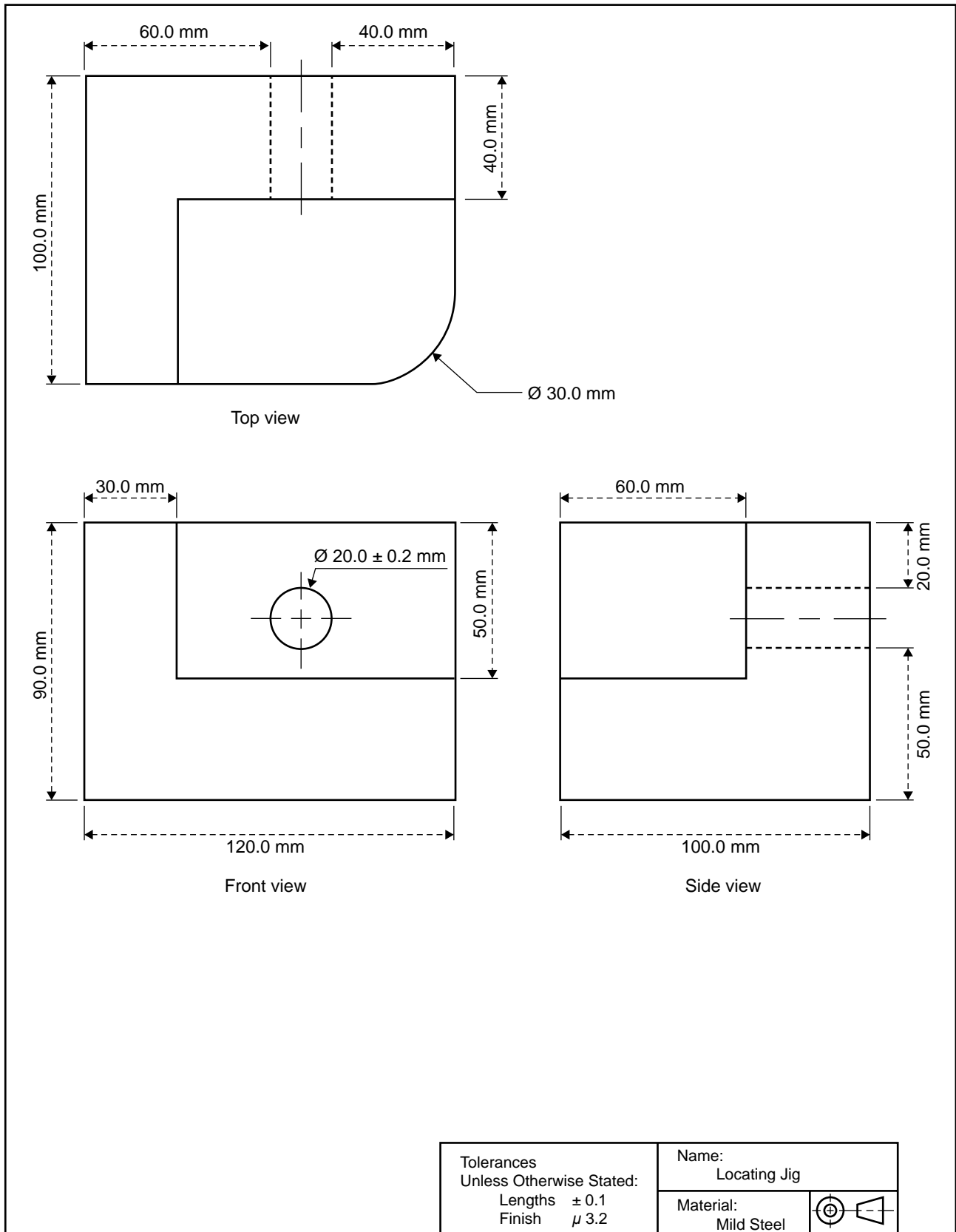
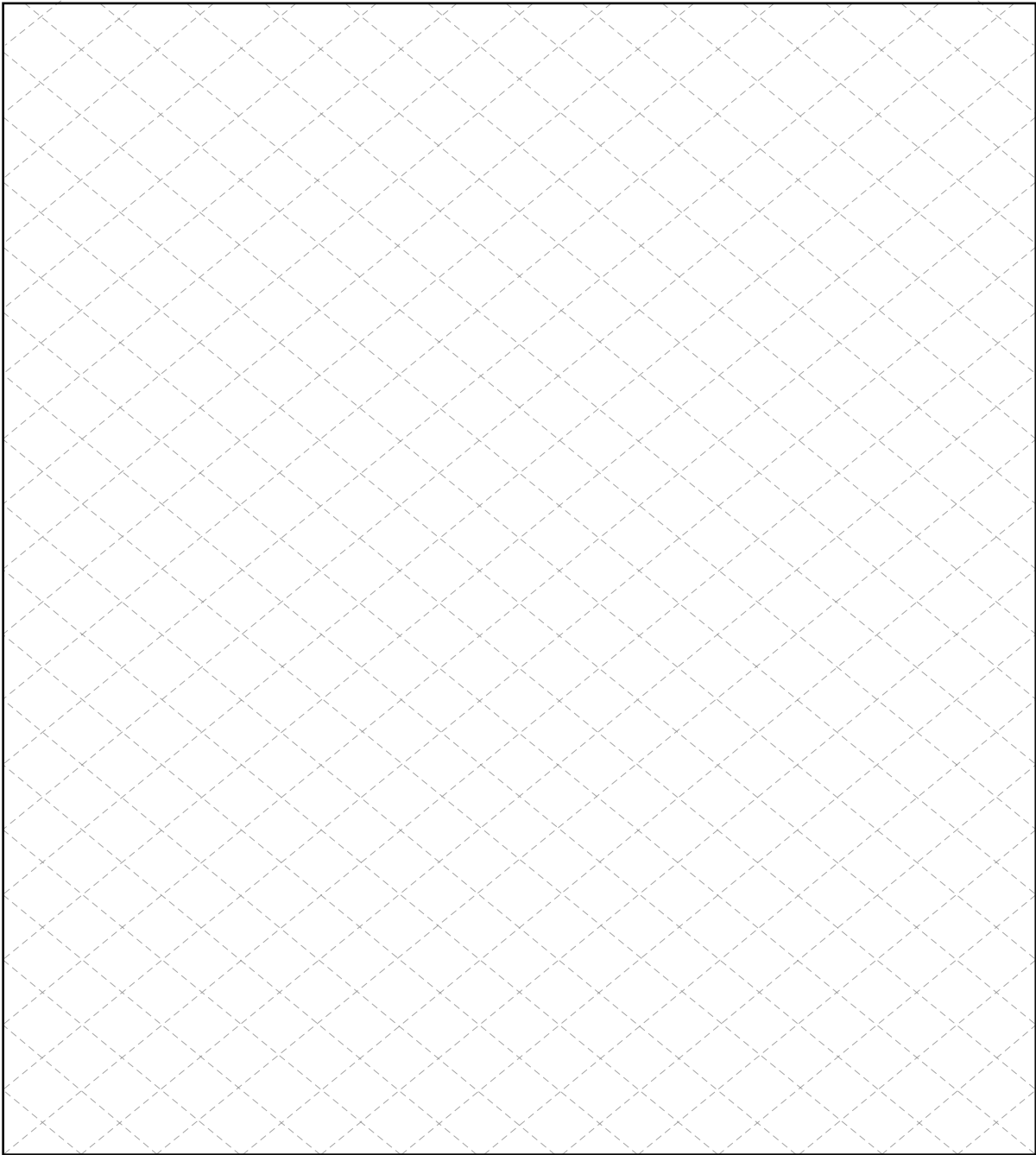


Figure 8

Sketch an isometric view of the locating jig in the space provided below.



Use the following information to answer Questions 15–19.

HG Engineering Works utilises the 5S system. It constantly and routinely collects all scrap metals for recycling, including all the swarf and off-cuts. All the mixed metals are thrown into an open dumpster, shown in Figure 9, which is kept in the workshop area. When full, the dumpster is collected by a metals recycling truck.

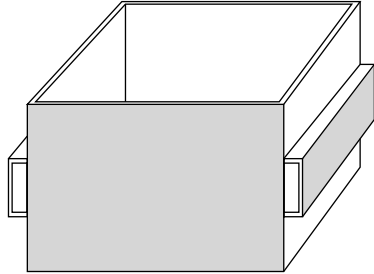
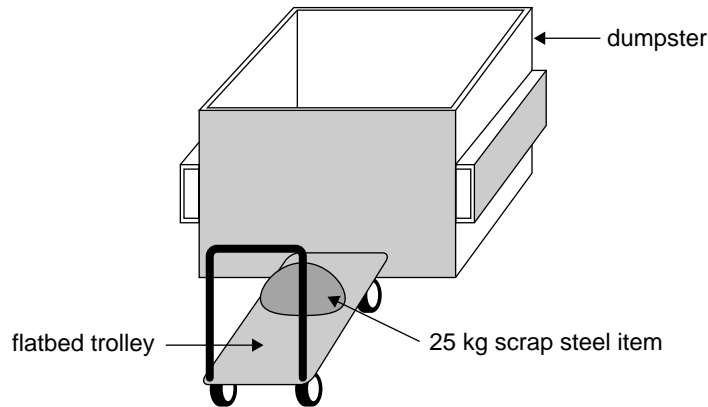


Figure 9

The dumpster has internal dimensions of 1400 mm (L) \times 1150 mm (W) \times 930 mm (H), with slots on two sides for dumpster truck forks.

Question 15 (3 marks)

Find the volume of the bin. Show your working. Write your answer in cubic metres, rounded to two decimal places. (volume = L \times W \times H)

Question 16 (2 marks)**Figure 10**

For occupational health and safety (OH&S) reasons, the height of the dumpster is less than 1 m. Regularly, two workers use a flatbed trolley, shown in Figure 10, when scrapping steel items that are up to 25 kg each into the dumpster.

Describe the process two workers would use when lifting a 25 kg scrap steel item into the bin.

Question 17 (6 marks)

A sustainability audit of HG Engineering Works resulted in a list of recommendations. One major recommendation was that the scrap metals be separated for disposal, that is, ferrous metals and non-ferrous metals be separated into individual bins.

a. What are ferrous metals? 1 mark

b. Provide two examples of **non-ferrous** metals. 2 marks

1. _____

2. _____

c. Describe **one** common and easily used technique to determine whether scrap metals are non-ferrous. 1 mark

d. Explain how the early separation of the scrap metals could increase the sustainability of the business. 2 marks

Question 18 (8 marks)

Other recommendations from the sustainability audit of HG Engineering Works are given in the table below. The recommendations are ranked from 1 to 4, where 1 would have the greatest impact on sustainability and 4 would have the least impact.

Explain why each recommendation would be ranked in the order shown.

Sustainability recommendation	Rank	Explanation
Rework the steel off-cuts instead of sending them to scrap metal waste and utilise directly in another part of the production process.	1	
Install solar panels on the building's roof to supplement the peak electricity used (coal-fired). On a sunny day, the solar panels could meet half of the office's requirements.	2	
Use off-peak, night-rate electricity (coal-fired) rather than peak, day-rate electricity (coal-fired) to power the induction furnaces.	3	
Treat and then re-use the manufacturing wastewater in an ornamental fountain and pond at the front of the office.	4	

Question 19 (6 marks)

The sustainability recommendations are to be implemented soon and the dumpster is to be upgraded.

The specifications for the upgrade of the dumpster are as follows:

- only to be used for scrap steel
- stored outside with a fitted weatherproof lid
- height of the front of the dumpster to be less than 1 m
- enlarged to accommodate another 0.39 m³ (volume) of scrap metal
- dumpster to weigh less than 3 tonnes when full

Increased space and a sloping plastic lid are fabricated and then attached neatly to the dumpster.

The dimensions are shown in Figure 11.

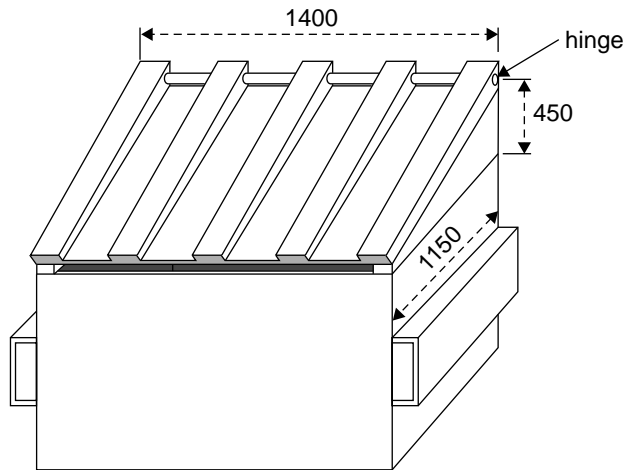


Figure 11

- a. Calculate the volume of the **new section** added to the dumpster. Show your working. Express your answer in cubic metres, rounded to two decimal places. 3 marks

- b. Would the additional space provide the required 0.39 m³ of extra dumpster volume? 1 mark

- c. The enlarged dumpster typically contains 2 tonnes of scrap steel. A dumpster truck collects the scrap for a fee of \$35.00 each time. The scrap is automatically weighed when collected. For the 2 tonnes of scrap steel, HG Engineering Works is paid 11 cents per kilogram.

Determine the typical amount that would be paid to HG Engineering Works for each collection of its scrap steel. Show your working. 2 marks
